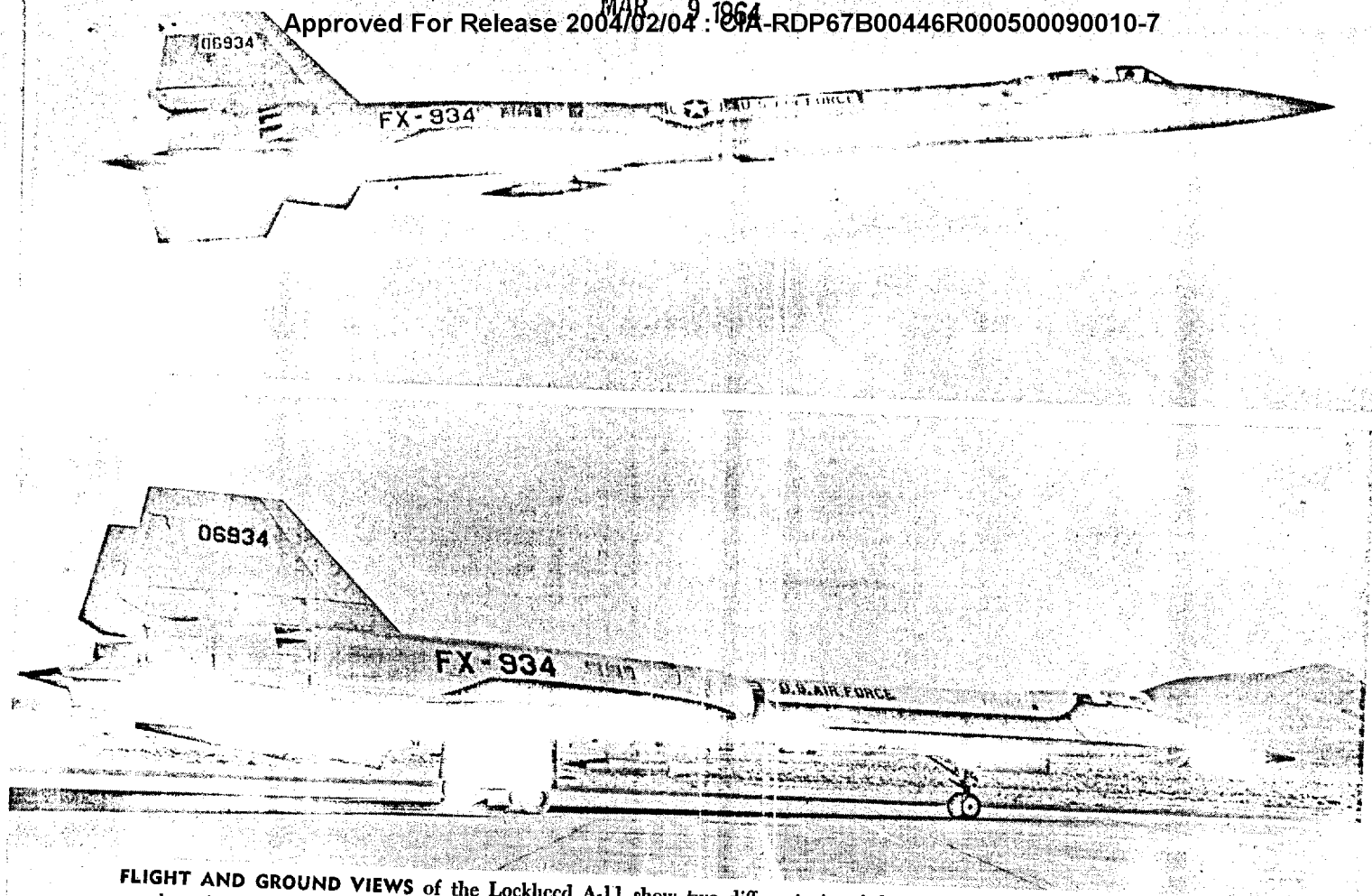


FLIGHT AND GROUND VIEWS of the Lockheed A-11 show two different aircraft both with the same temporary Air Force identification numbers for security reasons. Flight view is an earlier version with larger port hole for third crew member and shows the large folding ventral fin extended. Note X-15 type fairing along forward fuselage, high angle of attack in cruise attitude and streamlined electronic reconnaissance pod pylons mounted below engine nacelles. Ground view of later model was taken at secret Nevada operational base and shows double vertical fins and twin afterburner configuration. Razor thin double delta-wing is barely visible from side.

A-11 Proven in Reconnaissance Missions

Washington—Lockheed A-11 is a Mach 3.5 special-purpose aircraft that has already flown long-range reconnaissance missions over communist territory. During operations over the past two years, it has proved its ability to outfly any air defense system now in operational use.

The A-11 was originally designed primarily for long-range reconnaissance and other clandestine missions at altitudes exceeding 100,000 ft. Because of its size, range and altitude performance it is also capable of specialized precision nuclear strike missions. Top Defense Dept. officials deny that it now has such a role.

First public disclosure of the A-11's existence was made on Feb. 29 by President Johnson in his first nationally televised press conference here. He said the A-11 had been tested in sustained flight at speeds greater than 2,000 mph. at altitudes above 70,000 ft.

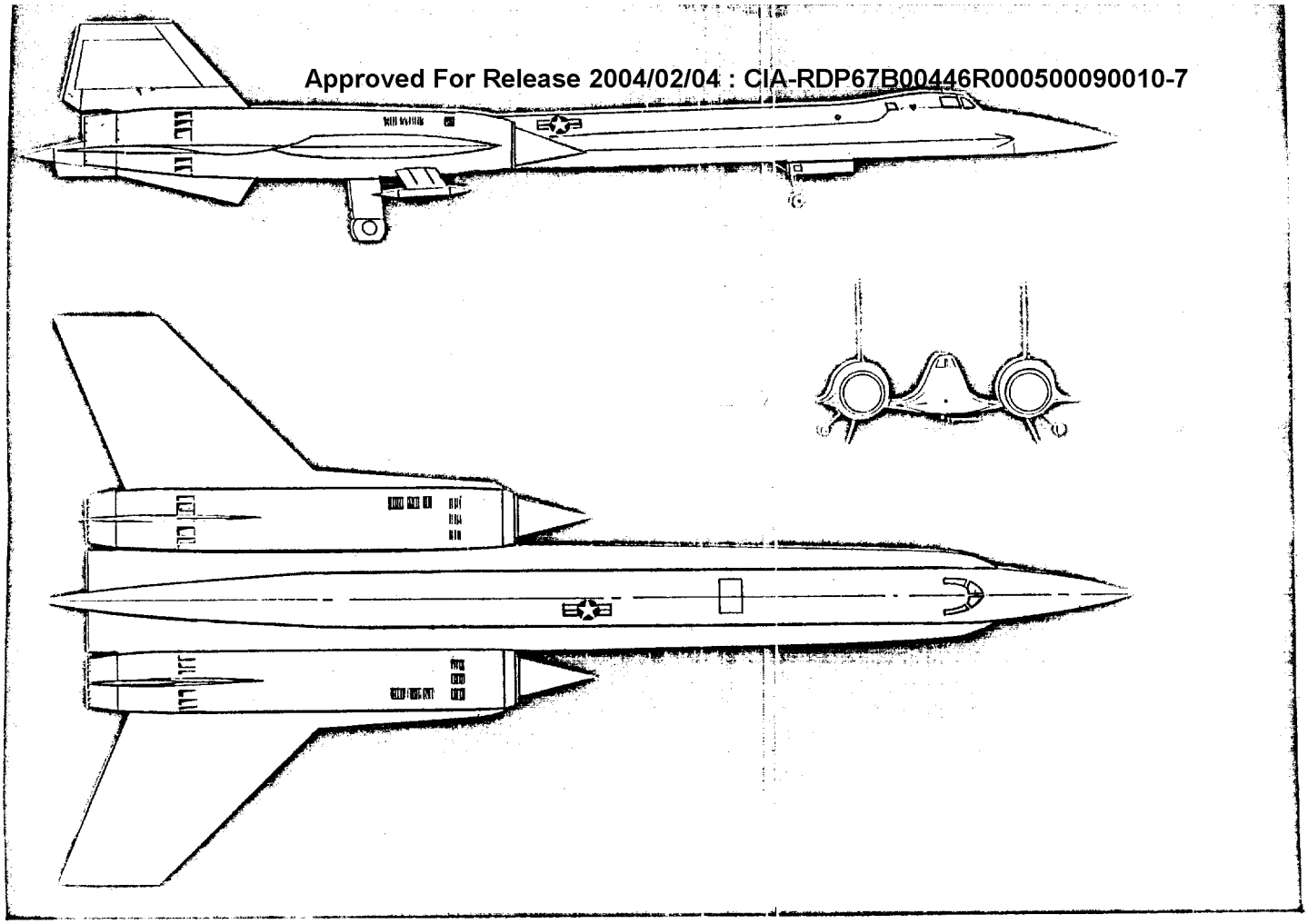
The A-11, which is a Lockheed Aircraft Corp. designation and not a military identification, has been under development since 1959 as a successor to the U-2 reconnaissance aircraft that flew unmolested over the Soviet Union, China and other Iron Curtain countries for four years between 1956 and 1960.

Lockheed won a design competition in 1958 for the U-2 successor, with Convair's Ft. Worth Div., Boeing, and North American as its competitors. The A-11 development project was headed by Clarence L. (Kelly) Johnson, who designed the U-2 in the same maximum security area of the Lockheed Burbank, Calif., plant known as the "Skonk Works."

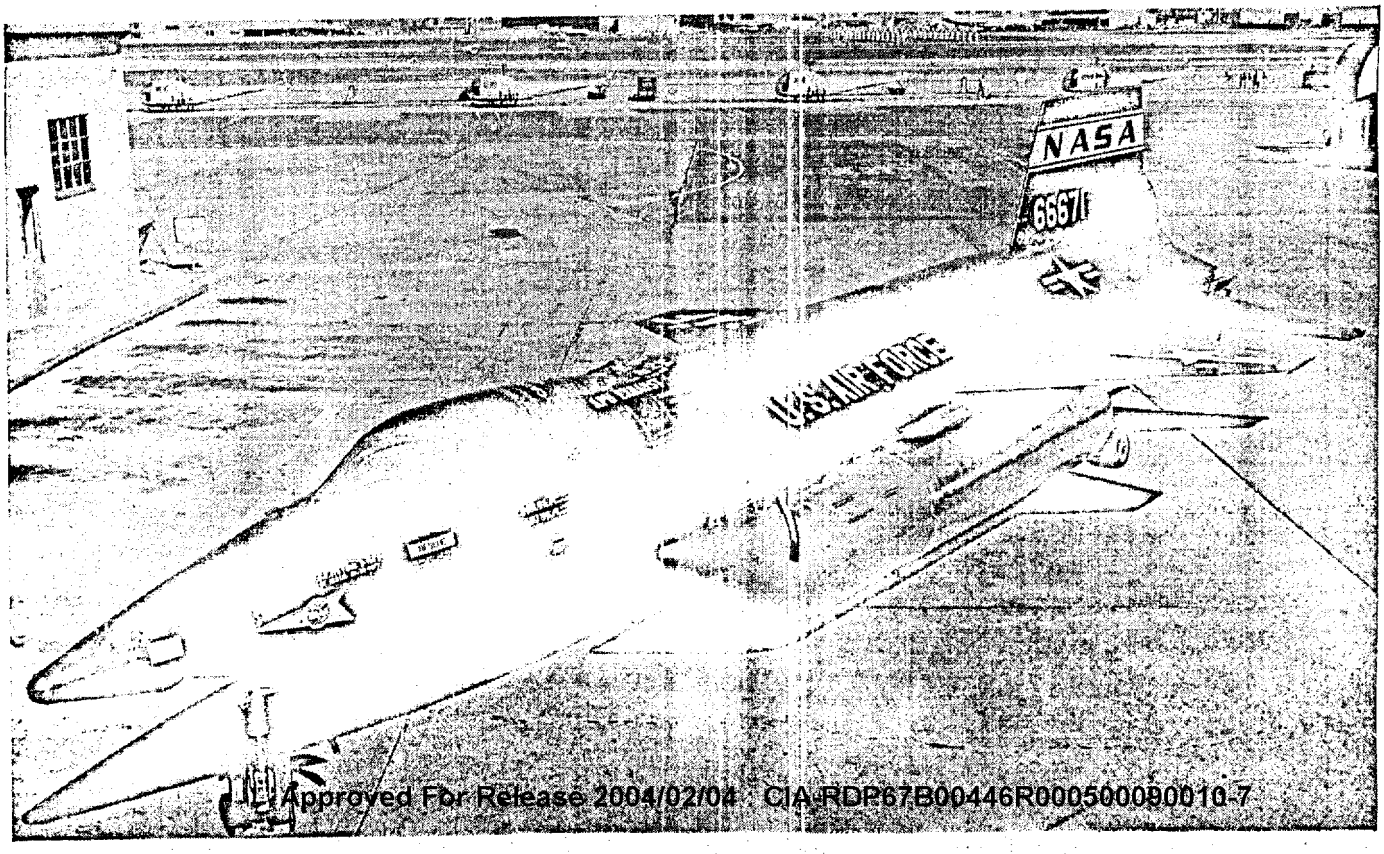
The first A-11 was trucked in subassemblies from Burbank to a secret Nevada base known as "The Ranch" in 1961 in a series of specially-built vehicles. It was assembled and flight-tested from this base late in 1961, a little more than 2½ years after the project began. At least eight A-11 aircraft have been operating from this Nevada base during the past two years. A total of 50 aircraft are on order.

Like its predecessor, the U-2, the Lockheed A-11 has been optimized for maximum speed at maximum possible altitude, reaching its top speed slightly above 70,000 ft. and retaining speed above Mach 2 up to 100,000 ft. It is the first military aircraft in the world to achieve sustained Mach 3 flight, and it has a range considerably in excess of the U-2's 4,000-mi. capability. The A-11 airframe design draws heavily on the technology of the North American X-15 research aircraft, which has reached a maximum speed of 4,104 mph. for short periods, combined with Lockheed's earlier supersonic experience with its F-104 Mach 2 interceptor and its X-17 hypersonic ramjet research vehicle.

The A-11 design, like that of the U-2, was optimized for the maximum performance level at considerable sacrifice in structural strength and its han-



LOCKHEED A-11 (three-view, above) drew extensively on X-15 technology. Similarities can be seen in the fin configuration and fuselage bulges on the Mach 8 X-15A-2 (below), which is the rebuilt No. 2 X-15 recently rolled out by North American. Liquid hydrogen tanks, plumbing, and attachment points are added for testing of externally mounted ramjets and other experiments (AW Feb. 17, p. 116). Other changes include addition of an external 757-gal. liquid oxygen tank and a 1,041 anhydrous ammonia tank. These external propellants push the vehicle to a speed of 2,000 fps. at 70,000 ft., after which internal propellants then continue acceleration to 8,000 fps. in level flight at 100,000 ft.



dling capability over speed ranges. It is a relatively light aircraft structurally for its performance range and has an extremely high power-weight ratio.

The A-11 airframe is constructed primarily of titanium alloys including wing spars, skin and small hardware such as fasteners, nuts and bolts. These alloys include combinations of titanium with aluminum, vanadium, tin and molybdenum. The turbojet engines also use considerable titanium. Steel honeycomb is also used. In describing the A-11, President Johnson said:

"One of the most important technological achievements in this project has been the mastery of the metallurgy and fabrication of titanium metal which is required for the high temperatures experienced by aircraft travelling at more than three times the speed of sound."

The basic A-11 design has gone through several refinements, as indicated by photos released by the White House of two different aircraft configurations, both using the same temporary identification number panels, apparently for security reasons. The aircraft, shown in flight, apparently is an earlier prototype and has a larger porthole for the third crew member. The other version, shown on the ground, has a smaller porthole behind the cockpit and minor differences in the engine afterburner configuration and thrust reverser ports.

Bulk of the fuselage is devoted to fuel tanks with a sloping concave-convex fairing running along both sides of the fuselage to house engine and flight control systems cables, and to provide an aerodynamic lifting surface. This fairing runs from the point where the nose radome ends to the point at which the engine nacelle supports join the fuselage. The two-man cockpit is similar to the earlier X-15 design with relatively small, heat-resistant glass panels.

The fuselage tapers to a coned fairing that houses a drag parachute to help brake landings. The tricycle gear uses a triple-tired main gear retracting inward into the wing roots while the double-wheeled nose gear retracts forward into the fuselage.

The A-11 has a razor thin, double-delta wing reflecting the aircraft's optimization for its maximum performance level. On one version of the A-11 the wing appears to have considerable conical camber, while on another version it appears to be "washed out" in the area where the angle of sweep changes. The type of wing and angle of the engine diffusers indicates that the A-11 cruises at a high angle of attack at its maximum performance speed and altitude.

The A-11 is powered by two Pratt & Whitney J58 turbojets with converging-diverging afterburners and thrust reversers. This model J58, designated JT11D-20B, produces about 34,000 lb. static thrust with afterburning. Afterburners appear to be the short type usable primarily for takeoff. The 6-ft.-dia. engine intakes have a large fixed conical diffuser rather than variable geometry intakes, indicating again the optimization of the configuration for high-speed, high-altitude performance. Special fuels are used.

The J58 was developed under Navy sponsorship at Pratt & Whitney Aircraft's Florida Div. at West Palm Beach, although production has been shifted back to the Connecticut plants since liquid hydrogen rockets became the top priority of the Florida Div. A fan-burning version of the J58 has been proposed for the U. S. supersonic transport program by P&W (see p. 29).

The J58 originally was planned for use in the nuclear aircraft program, and later was designated a backup engine for the General Electric J93 turbojet that powers the North American B-70.

The A-11 was designed primarily to carry a heavy load of photographic and electronic reconnaissance equipment. Some of the sensors for these systems are mounted externally on two pylons extending below each engine nacelle. Other antennas are mounted under the fuselage. The A-11 is equipped with an astro-inertial guidance system for long-range navigation.

After Lockheed won the A-11 contract in 1958, unusual security measures were enforced to preserve secrecy of the project. Among these security measures were dummy corporations to deal with sub-contractors, use of unmarked trucks to pick up parts and materials, cash payments for supplies, and air-lock type entrances and exits from the "Skonk Works" facilities.

The unusual A-11 configuration has been spotted by airline pilots and USAF Air Defense Command F-104 interceptors during its flight test program, but tight security clamps were applied to each spotter.

The A-11 was also being picked up with increasing frequency on air traffic control radar operated by the Federal Aviation Agency, and was giving rise to another rash of "flying saucer" rumors. The public announcement of the A-11 probably indicates a wider deployment of the aircraft from the maximum security base in Nevada, which would make it difficult to continue denying the existence of the radical new configuration.

Like its U-2 predecessor, the A-11 will probably find wide application as a research aircraft and as a flying test bed for such advanced systems as the Hughes Phoenix missile and fire control system being developed for the joint USAF-Navy F-111, and missile and space vehicle guidance systems.

McNamara, Congress Differ on A-11 Role

By George C. Wilson

Washington—Defense Secretary Robert S. McNamara last week put himself in direct opposition to key members of congressional military committees by flatly declaring "the A-11 is an interceptor, it is being developed as such, and beyond that I have nothing further to say on its use."

McNamara further confused the interceptor funding picture in Congress by declaring that the $40 million Air Force sought for an advanced interceptor was really for accelerating development of the Lockheed Mach 3.5 A-11, not to start on a new aircraft.

"They wished to use the additional funds on the IMI" (improved manned interceptor), McNamara said, "not primarily for development of the airplane, which as you can see has progressed very satisfactorily, but rather to speed its production, particularly by the procurement of certain long-lead tooling items, to accelerate the development of the fire control system for which funds are already provided in the budget, and to purchase certain other long-lead materials associated with production. It was for this purpose that they wished to reallocate $40 million with the Defense Dept. budget." He refused to say whether the A-11 was designed as an interceptor, as opposed to being developed as one.

The House recommendation to earmark $40 million for an advanced interceptor was dropped in the House-Senate conference on the Defense Dept. authorization bill (see p. 21).

In short, McNamara went further than President Johnson in portraying the A-11 as an interceptor. But key lawmakers told AVIATION WEEK & SPACE TECHNOLOGY that they regarded the A-11 as an advanced U-2 or as a research vehicle, and therefore see no need to abandon the drive for an advanced interceptor immediately and certainly not for the advanced manned precision strike system (AMPSS), which McNamara regards as premature (AW Mar. 2, p. 25, 29).

The attitude toward the A-11 and its

influence on congressional funding was typified by a leader on the House defense appropriations subcommittee, who said: "We certainly have known about the A-11 for years. But this project is independent of the question about whether we need a new bomber and interceptor." The fact that House members fully informed about the A-11 still voted to authorize $52 million for the AMPSS and $40 million for an advanced interceptor is evidence of this.

Chairman Richard B. Russell (D.-Ga.) of the Senate Armed Services Committee said on Mar. 1—the day after President Johnson disclosed the A-11—that its existence was the reason his committee refused to go along with the House and authorize the interceptor money. But the assumption that the A-11 would satisfy the Air Force's desire for an interceptor is already being challenged.

House View

Chairman Melvin Price (D.-Ill.) of the House Armed Services research and development subcommittee is among those who voted for the interceptor money. He said the A-11 justifies the Senate's action in denying the interceptor funds until the situation can be studied further. However, he stressed that the A-11 cannot be regarded at this time as an interceptor. He said his own subcommittee plans to investigate the feasibility of making the A-11 an interceptor.

Asked whether the A-11 could satisfy demands of those in Congress for an advanced strategic aircraft, Rep. Price said: "It is not the complete answer. It furnishes a platform for where we go from here." Rep. Leslie C. Arends (Ill.), ranking Republican of the House Armed Services Committee, said it was too early to know whether the A-11 could fulfill the interceptor need, but added that it certainly did not change the bomber picture. Similarly, a ranking Republican on the House defense appropriations subcommittee emphasized that it appears the A-11 might be adaptable to a number of missions, depending on what further testing and military strategy dictates.

These appear to be the major political results of the A-11 disclosure:

- **Congressional drive** to finance development of an advanced interceptor has lost its sense of urgency, but was not derailed altogether. This promises to delay the appropriation of anything like the $40 million the House authorized until the A-11 as an interceptor is assessed. But Congress would approve reprograming funds to develop an interceptor in Fiscal 1965 if the Administration suddenly changes its mind about the need for it.
- **Campaign to spend more** for a new bomber than the $5 million in study money McNamara is requesting for Fiscal 1965 will continue unabated, because a large segment of Congress, supported by the joint chiefs of staff, feels the U. S. is planning to abandon manned bombers in favor of missiles too soon. So the Air Force still has a better-than-even chance of getting more AMPSS money, especially since President Johnson has portrayed the A-11 as an interceptor rather than a bomber and will not want to antagonize Congress by refusing to spend any of the extra money appropriated (AW Jan. 13, p. 25).
- **The new aircraft** weakens critics of the Administration's no-new-start policy on major weapons, but strengthens the hand of those who have assailed McNamara's F-111 (TFX) decision.

President Johnson said Feb. 29 that "one of the most important technical achievements in this project has been the mastery of the metallurgy and fabrication of titanium metal which is required for the high temperatures experienced by aircraft traveling at more than three times the speed of sound." In contrast, McNamara rejected the Boeing design for the supersonic F-111 partially on grounds of the proposed use of titanium (AW Mar. 25, p. 24). In a statement filed Mar. 13, 1963, with the Senate Permanent Investigations Subcommittee, McNamara said:

Titanium Use

"The third area in which the Boeing approach involved greater development risks was its extensive use of titanium in its wing carry-through structure. We have had some experience in the use of titanium in other Department of Defense weapon systems, but mainly in heat-resistant applications and where high stress levels in thick plates are not involved. The [illegible] observed that data concerning the fatigue design properties of titanium, in the thickness Boeing proposed to use in the wing carry-through structure, is very limited, and that this raises the question of the advisability of using such thickness.

"The report further commented that the effect of temperature on structural details, especially in the aluminum-to-titanium splice, can be expected to be quite pronounced in producing metal fatigue. And the report concluded the Boeing fatigue test program showed lack of realism. In fact, Col. (Charles A.) Gayle, the TFX system project officer, sent a letter to the competing companies pointing out that, in the judgment of the Aeronautical Systems Div., it was not advisable to use titanium in fittings which are subject to heavy section areas because of a lack of data relating to such use. If Boeing's proposed use of titanium did not work out and heavier steel had to be used to replace the lighter metal, I realized that not only would the operational capabilities of the Boeing plane suffer, but additional costs would be incurred."

McNamara said that General Dynamics, which won the $7-billion F-111 contract, did not propose "relatively unusual applications of an exotic metal."

The successful use of titanium in the A-11 (see p. 16), even in fittings, is being cited to assail the F-111 decision. Chairman John L. McClellan (D.-Ark.) of the Senate investigating subcommittee said, "they're in trouble on the TFX and I know it." Air Force Secretary Eugene M. Zuckert admitted during recent congressional hearings on his budget that the Navy was dismayed about the heaviness of the F-111. Zuckert has named a committee to study the problem. Ironically, the only solution may well be more extensive use of lighter titanium.

McClellan's Opinion

"It will come as no surprise at all," Sen. McClellan said, "that the Pentagon officials who rejected titanium in the Boeing design will soon approve and order its use by General Dynamics in the TFX plane." He said "it has long been known that this metal has been used safely."

The Johnson Administration, anticipating that interpretation about the success with titanium on the A-11, has issued this statement: "It was specifically because of the technical knowledge obtained in the A-11 program that it was possible to evaluate the problems involved in Boeing's use of titanium, and to draw that conclusion." Government sources said it was correct to infer from this statement that the government felt it knew more about the problem in this instance than did Boeing.

A-11 Suppliers

Among major suppliers for the Lockheed A-11 Mach 3.5 special mission aircraft are:

- Pratt & Whitney Aircraft, North Haven, Conn., J-58 turbojet engines.
- Garrett AiResearch, Los Angeles, environmental control system.
- Bendix Pioneer-Central Div., Davenport, Iowa, instruments.
- Honeywell, Minneapolis, flight control system.
- Lockheed Electronics Co., Plainfield, N. J., avionics components.
- Sundstrand Corp., Denver, hydraulic system.
- Exotic Metals Products Co., Pasadena, titanium alloys.
- Bridgeport Brass Co., Niles, Ohio, titanium alloys.